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THE ART AND PRACTICE OF SUBMARINE SIGNALING

BY HENRY L. HIGGINSON

THE history of all inventions which have been important factors in the development of civilization and landmarks of progress follows strikingly similar lines. First there is the bold conception in the mind of the inventor, who has dreamed dreams and devoted long days and nights to the working out of his particular theory. In the face of jeers from his contemporaries, in spite of the discouragements of failure, he persists undaunted. He is inspired with an idea, and, ignoring all obstacles, works on with unflagging zeal and undiminished hope until at last success crowns his efforts. What men have called a figment of the imagination has at last become a tangible reality.

At this stage of development, when the inventor has pronounced his work perfect and a jury of his peers has commended it as suited to the purpose for which it is intended, the battle has been only half won, or, it may be, not won at all. Many an idea which men have worked and dreamed over for years, for which they have starved and suffered, has borne only the fruit of disappointment because of its utter impracticability. Many others, brought forth after years of unceasing effort by the inventor, have been rendered useless and have failed of their purpose through inability to convince people of their value; for an invention once perfected can only become of real use through general adoption in the fields for which it is suited, and the education of the public to this end is quite as important and essential as the preliminary work on the apparatus itself. It is on this account that I say an invention once perfected has only passed through the first chapter of its history, and it often takes years to win a public hearing, to secure its general adoption, and thus enable it to enter on its career of usefulness to man.

Take, for instance, the history of the telephone. For many years Mr. Bell worked on the problem of transmitting sound over a wire, and men laughed at the idea. At last the thing was actually accomplished in a small way and the sneers became less audible; but even then there was no conception of the telephone as a universal necessity and accompaniment of every-day life. The Bell Telephone Company passed through years of struggle, which killed some good men, in the effort to put it on its feet and convince the public of its usefulness.

Wireless telegraphy is a more recent example. Its application was understood, but not fully appreciated for some years. Time, persuasion, even disaster, were required to force the adoption of what is now recognized as a public necessity.

For several years I have been interested in a device which can guard ships against the perils of fog. The instrument has been perfected, the apparatus has been brought to a commercial standard, and the problem now is to extend its use by its introduction on all ships and its installation at all danger points on the coast, so as to render ocean travel as safe as it is possible to make it. To persuade Government officials, ship-owners, the great public, in fact all who sail the seas, of the efficacy of this invention, and thus make possible its adoption for the sake of the welfare of humanity is the problem which now confronts us. We have now reached the stage where from the standpoint of the public good we may legitimately enlist the aid of public opinion to secure its universal adoption.

For twenty-five years men have been trying to devise methods of transmitting and receiving sounds under water, for it has long been known that water is a steadier and more constant conductor of sound than air, as well as an effective and quick conductor. Sound through the water is conveyed at the rate of about 4,400 feet per second, or four times as fast as through the air. Furthermore, the passage of sound through air is often uncertain and irregular because the air is full of currents and of " sound-holes," not being of uniform density. Ships have collided and great loss of life ensued, as in the case of the *Storsdadt* and the *Empress of Ireland* a short time ago, because the officers could not judge the distance or direction of whistled warnings sent through the air. There are many instances where ships have gone on the rocks within hearing distance of ordinary bell buoys and sirens, because of inability to hear the warning signal or to judge of the direction whence it came. The captain of the Steamship *California* which went ashore on Tory Island in June of this year reported that, though only about half a mile from the lighthouse, he did not hear the fog-horn. Endless examples of this sort might be enumerated to illustrate the uncertainty of sound transmission through the air. The point, however, is that sounds conveyed through water are not subject to such local disturbances, are more certain, regular, and rapid, and therefore more reliable.

Submarine bells placed under water at dangerous points on the coast or hung over the side of lightships are rung by mechanism on shore or lightship, or sometimes by the action of the waves themselves, and the sound is transmitted through the water to the ship at sea. The ship equipped to receive these bell signals have " listening tanks " on each side, and by listening on alternate sides the navigator can tell the direction from which the sound of the bell is coming, and can thus locate within a point the source of the sound. Mariners are in this way able to avoid dangerous places on the coast, even in thick fog, and to enter harbor when ships not so equipped must wait until the fog lifts. The apparatus is further adapted to intercommunication between submarine ships and their tenders.

The placing of bells at dangerous points on the shore is of little use, however, unless the ships passing those points are equipped to receive the signals. One is helpless without the other, and the full benefit of this useful invention can only be obtained when all ships are equipped to receive the signals, and all danger points on the coast and in the harbors of the world have bells sending out their warnings and thus create a " wall of sound " for the protection of all who sail the seas.

A most important development in submarine signaling has lately been brought about by Professor R. A. Fessenden, who has made possible inter-ship communication by means of his Submarine Telegraph Oscillator. This oscillator is a kind of electric motor which causes a heavy steel disk to vibrate with a certain frequency and thus produces sound waves which travel through the water for many miles. This device marks a long step forward in the art and practice of submarine signaling. With it such a disaster as that which recently occurred in the St. Lawrence, when the *Empress of Ireland* was rammed and sunk in a fog with the consequent loss of many lives, might have been averted had both ships been equipped with this oscillator. In fact, it might have been averted had the *Storsdadt* carried even an ordinary emergency bell, which, hung over the side, would have warned the ill-fated steamer and enabled her, through her receiving device, to locate the position of the *Storsdadt* and thus avoided the collision.

The oscillator is not only a powerful sound-producer, but also a sensitive sound-receiver, and with it direction of sound under water can be detected at a considerable distance—not only the sound of another oscillator, but that of a submarine bell or even the throb of a ship's engines. It is of further use in locating the direction of silent bodies such as icebergs because of the echo which a solid body of this sort gives under water. Experiments in this connection were carried out last April on board the United States Revenue Cutter *Miami*, of the Ice Patrol Service, off Newfoundland Banks. There it was found possible to ascertain the direction and distance of large icebergs. This is attested by the official report of the captain of the *Miami*. In fact, we may say with certainty that had the *Titanic* been equipped with this device she might have determined the presence and location of the iceberg, and thus the greatest sea-tragedy of modern times might have been avoided.

The only power which can force the adoption of the means of preventing accidents which I have sketched is that of public opinion. This, when sufficiently aroused, will compel ship-owners, governments, and the traveling public to demand such equipment as will prevent accidents, instead of trying to save lives after the accident has occurred. When once the fact is fully realized that very many losses of life and property are unnecessary, and therefore criminal, it would seem the duty of national governments to order the use of this apparatus on all passenger-ships.

An ounce of prevention is worth a shipload of life-boats.

HENRY L. HIGGINSON.